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Title

Hydro-mount

Description

The invention relates to a hydro-mount comprising a support bearing and an end bearing which support each other by means of a spring element made of a resilient material, the spring element enclosing a work space filled with a damping liquid.

Prior Art

Hydro-mounts of the afore-indicated kind are generally known, for example from EP 0 547 287 B1. The spring element of the prior-art hydro-mounts in most cases consists of natural rubber or EPDM, the aforesaid materials being heat-resistant up to a temperature of at the most about 150 °C. Exposure of these materials to temperatures above 150 °C results in adversely modified use properties and/or destruction of the material.

The afore-mentioned heat resistance is insufficient especially when a hydro-mount is used as engine mount in modern motor vehicles. In modern motor vehicles, the engine compartments are often extensively enclosed in order to reduce sound emissions from the engine compartment into the surroundings as efficiently as possible. Moreover, engine compartments are becoming smaller and smaller so as to be able to meet the increasing requirements placed on motor vehicle aerodynamics . For these reasons, high temperatures are not sufficiently kept away from the hydro-mount and dissipated to the surroundings.

Heat shields used to protect hydro-mounts are not very satisfactory, because they require additional installation space and their separate fabrication leads to increased costs.

Presentation of the Invention

The object of the invention is to further develop a hydro-mount of the afore-indicated kind so that it can be exposed to temperatures appreciably above 150 °C without adversely affecting its use properties and/or its service life and so that it does not have larger dimensions than the common prior-art hydro-mounts.

According to the invention, this objective is reached by means of a hydro-mount according to Claim 1. Advantageous embodiments are covered by the subclaims.

To reach said objective, the spring element is made of a high temperature-resistant material, preferably a silicone elastomer, the side of said spring element facing the work space being provided with a protective layer consisting of a material that is resistant and impervious to the damping liquid.

The spring element made of silicone can be exposed to much higher temperatures than can a spring element made of, for example, EPDM without its use properties being adversely affected and/or its service life shortened. With the aid of the spring element consisting of silicone, the hydro-mount of the invention can readily be exposed to temperatures in the range of up to 200 °C and is thus intended for use as engine mount in very compact and/or fully enclosed engine compartments. The protective layer is provided, because the commonly available, inexpensive silicone materials are not resistant to the damping liquid present within the work space of hydro-mounts. The damping liquid in most cases consists of a mixture of glycol and water. Without a protective layer, this mixture would penetrate into the surfaces of silicone spring elements and during use would diffuse through them.

The use of special silicone blends and/or a special damping liquid to avoid these problems is unsatisfactory from an economic standpoint.

The protective layer is provided for the purpose of protecting the surface of the silicone spring element facing the work space. The protective layer can be made of a material usually employed for spring elements, for example of natural rubber or EPDM, these materials having already been shown to be suitable for fabricating hydro-mount spring elements. These materials are resistant to

the damping liquid and are impervious thereto.

The protective layer is sized so that it exerts only a negligible effect on the use properties of the hydro-mount.

As is usual for conventional hydro-mounts, the spring element can be configured essentially as a truncated cone. Those skilled in the art of designing hydro-mounts can adapt the configuration and/or sizing of the spring element to the particular application in question without having to show inventive activity. As far as the design and/or sizing is concerned, there are no pronounced differences between EPDM spring elements and silicone spring elements so that the geometries of proven EPDM spring elements can be applied to silicone spring elements without making any essential changes.

The spring element and the protective layer can be bonded by adhesion. This has the advantage that the use properties of the hydro-mount are easier to predict, because there is no mechanical interlocking between the spring element and the protective layer. The different materials constituting the spring element and the protective layer are located in clearly separated regions. There is no region wherein the material constituting the spring element and the material from which the protective layer is made exist side-by-side, for example owing to frictional interlocking.

Adhesive bonding between the spring element and the protective layer can be achieved, for example, by spraying, during a first step of the process, the thin, cup-shaped protective layer of, for example, EPDM. In a second processing step, the silicone spring element is sprayed onto the protective layer which results is adhesive bonding in the region of the two mutually facing surfaces of the protective layer and the spring element. A reversal of the processing steps whereby the silicone spring element is sprayed in the first processing step and, in a second processing step, the protective layer of a relatively harder material, for example EPDM, is sprayed onto the silicone spring element is, in general, possible, but considering that during the spraying the comparatively softer silicone would cause the thin, harder layer of EPDM to wrinkle, such a process would not be without problems.

In another embodiment, the spring element and the protective layer can be connected to each other without adhering. The spring element and the protective layer can be connected nonadhesively. In contrast to adhesive connection between spring element and protective layer, the advantage of such an embodiment is that the spring element and the protective layer are fabricated separately and are assembled during the installation of the hydro-mount.

According to an advantageous embodiment, the protective layer completely covers the entire surface of the spring element facing the work space. A partly touching protective layer can provide additionally improved use properties.

The protective layer preferably consists of EPDM. The advantage is that, compared to a protective layer of natural rubber, EPDM is somewhat more heat resistant, and as a result the entire hydro-mount can be exposed to higher temperatures. At any rate, the temperature of the protective layer is below its critical range of 120 to 150 °C even when the spring element is externally exposed to a temperature of up to 200 °C. The spring element is responsible for the good use properties of the hydro-mount namely its high heat resistance and advantageous spring action. The protective layer provides sufficient resistance to the damping liquid.

The ratio of the thickness of the spring element at its thickest point to the thickness of the protective layer, both considered in the longitudinal direction of the hydro-mount, can amount to at least 2. Preferably this ratio amounts to at least 8. The smallest possible thickness of the protective layer depends exclusively on the resistance of the protective layer to the damping liquid. In this respect, the protective layer has no other purpose. The lower the thickness of the protective layer the smaller is the effect of the protective layer on the use properties of the spring element

Preferably, the protective layer has a thickness from 1 to 4 mm.

The protective layer can have the same thickness in all parts thereof. This simplifies the fabrication of the hydro-mount thus reducing its overall cost. Moreover, the effects of the protective layer on the use properties of the hydro-mount are then more predictable.

Brief Description of the Drawings

In the following, an embodiment of the hydro-mount of the invention is described in greater detail by reference to the figure. Tis figure shows schematically:

an embodiment of a hydro-mount wherein the spring element and the protective layer are adhesively bonded together.

Execution of the Invention

Figure 1 shows a hydro-mount which in its general configuration corresponds to conventional hydro-mounts. The hydro-mount comprises a support bearing 1 and an end bearing 2 that support each other by means of spring element 3. Support bearing 1, end bearing 2 and an air bellows 9 that accommodates volume without pressure enclose work space 5 and equalizing space 8 which are filled with damping liquid 4 and are separated from each other by a partition 10. In the embodiment shown here, partition 10 consists of a jet cage 11 within which is disposed a membrane 12 capable of vibrating in direction 13 of the vibrations introduced. Membrane 12 is surrounded radially on the outside by damping channel 14 which connects work space 5 and equalizing space 8 allowing flow to occur between them.

To damp vibrations of low frequency and high amplitude, the column of damping liquid present within damping channel 14 is displaced back and forth between work space 5 and equalizing space 8 in phase opposition to the vibrations introduced. To isolate the high-frequency, low-amplitude vibrations, membrane 12 can move within jet cage 11 back and forth in phase opposition to the vibrations introduced. The configuration of partition 10 can be as desired and it can correspond to the sufficiently known prior-art partitions for hydro-mounts.

Spring element 3 is made of silicone and on the side facing work space 5 is provided with a protective layer 6 which in this embodiment consists of EPDM.

Surface 7 of spring element 3 facing work space 5 is completely covered by and in touching contact with protective layer 6. In this manner, surface 7 of spring element 3 facing work space 5 is optimally protected from exposure to damping liquid 4, and undesirable noise during operation of the hydro-mount is prevented.

In this embodiment, spring element 3 and protective layer 6 are adhesively connected to each other, the protective layer of EPDM being sprayed in a first processing step. After the surface of protective layer 6 has solidified, spring element 3 consisting of silicone is sprayed onto protective layer 6. The spraying is carried out with the aid of an appropriate adhesion promoter.

In the embodiment shown here, the ratio of thickness of spring element 3 at its thickest point to the thickness of protective layer 6, in both cases considered in the longitudinal direction of the hydro-mount, amounts to 15, with all parts of protective layer 6 having the same thickness.

According to the invention, the advantage of the claimed hydro-mount is to be seen in the fact that said hydro-mount can be exposed from the outside, for example from the engine compartment of a motor vehicle, and through spring element 3 made of silicone to high temperatures in the range of up to 200 °C and that spring element 3 made of silicone is neither attacked nor penetrated by damping liquid 4. In view of the fact that protective layer 6 protects spring element 3 from exposure to damping liquid 4, expensive special materials for spring element 3 and/or a special and also expensive damping liquid 4 are not necessary. Hence, the hydro-mount can be fabricated economically.